



Technical Specifications

BUSES



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Section one: General

1.1 Purpose and scope

Through this standard, the LTC's aim is to 'enhance the attractiveness of urban public transport vehicles in order to encourage increased usage, with a particular emphasis on improving accessibility'.

This will have significant impacts on:

- ✚ Minimizing the rate of increase of urban traffic congestion
- ✚ The requirements for funding for roading and passenger transport
- ✚ Vehicle emission levels and carbon footprints by the use of cleaner fuels

Attitudes of commuters of Punjab for the use of buses for all urban travel, including commuter, shopping, school and recreational activities travel. The standard will specify requirements that apply to all new buses to be used in urban service as described below from the date of introduction, and may also include standards for existing used buses that must be met now or from the date indicated. In this manner, an improvement in the standards of buses will be achieved on a progressive basis without significant impact on existing fleet profiles.

LTC categories the buses as follow:

Small bus (SB)	13-21 seated passengers and including the driver
Medium bus (MB)	21-39
Large bus (LB)	over 39

Arrangement of requirements

The standard is arranged under the following general features headings:

Section one	General arrangements
Section two	Design and performance
Section three	Accessibility
Section four	Passenger safety
Section five	Passenger comfort and use
Section six	Facilities for passengers with disabilities
Section seven	Driver ergonomics and other general
Section eight	Existing fleet

Dimensions

All dimensions are in millimeters (mm).

The use of the two symbols < and > also includes the equal to or greater/lesser than, ~ etc.

Section two: Design and performance

2.1 Introduction

This standard is not aimed to be an engineering design or full performance specification, but the LTC wants to ensure that buses in urban service are seen to be of a modern design incorporating the latest technologies so that they give a very good quality of ride and comfort, and are capable of stopping, starting and moving into and out of traffic streams in a way that they are not seen to be any impediment to the general traffic performance.

2.2 Maximum vehicle age and fleet average age profile

The maximum permitted vehicle age <10 years.

2.3 Performance/Features

All sizes.

Acceleration	0-20 km/h <6 Secs
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	0-50 km/h <25 Secs
Range without refuel	<300 km or 12 hours
Emission	Min Pak 2
Noise	External <80 dBA for rear and mid engine, +4 dBA for in-service Internal < 75 dBA
Compartment insulation	Non-flammable, noise and heat insulation material.
Turning Radius(m)	90% of the Overall length
Gradeability(Percent)(Fully Laden)	Min 18
Braking from 30 Kph(m) (Fully Laden)	<10
Air Conditioning	If an air conditioner is fitted the above performance must be met.
Overhang	
Rear	Not exceeding 60 per cent of the wheelbase
Front	Not exceeding 45 per cent of the wheelbase upto a max of 2700 mm
Angle Of Approach (un laden)	Not Less than 9 Degree
Angle Of Departure (un laden)	Not Less than 9 Degree
Ramp Over Angle (half of the Brake Angle)	Min 4.5 to 5.1 degrees as per the wheel Base

2.4 Capacity Dimensions

SB	
Capacity	13-21 seated passengers including the driver
Seat/Standing	N.A
Overall length	<7Meter
Overall Width	~1.5 meter inclusive of Side mirrors
MB	
Capacity	21-39 seated passengers including the driver
Seat/Standing	At least 26/12
Overall length	< 9meter
Overall Width	~ 2.2 meter inclusive of Side Mirrors
LB	
Capacity	Over 39 seated passengers including the driver

Seat/Standing	45/25
Overall length	<12meter
Overall Width	~2.5Meter exclusive of side mirror

2.5 Gross Vehicle Mass

SB	Max 6000Kg
MB	Max 10000Kg
LB	Max 15000Kg

2.6 Transmission

SB	Manual/Automatic
MB and LB	Manual/Automatic

2.7 Suspension

SB	kneeling capability
MB and LB	

2.8 Chassis and Body structure

The chassis and associated components will be of a design and use protective material or techniques such that a bus can be expected to give 20 years reliable life under normal high-intensity urban operational conditions of service, with routine maintenance and without any structural changes.

Body Structure	Monocoque(Within five Years from specification application)
Rust Proofing	The Body and frame should remain rust free for minimum of 10 years.
Insulation	The body should be fitted with heat and noise insulation so that interior noise shall not exceed 75 DB during any part of the cycle

Section three: Accessibility

3.1 Introduction

The ease and speed of accessibility for passengers of all ages, sizes and mobility capability while both boarding and alighting a vehicle, as well as movement within the vehicle, is of prime importance because:

- ✚ It removes the perceived barrier that buses cannot be easily used by all members of the public whether able bodied or not.
- ✚ boarding and alighting times are much reduced, which can have a significant impact on the overall travel times and consistency of journey time of a bus service when compared with that of the alternative choices, ie using a private

Or company vehicle, cycling or walking.

Doors and aisle width, step heights, interior floors, seating configuration and revenue collection all impact on accessibility.

3.2 Doors

S.No	Description	Number of Doors
1	SB	1+one Emergency
2	MB	Min One+ one Emergency
3	LB	Min Two +one Emergency
Widths	Front door SB MB/LB Rear door	Clear space excluding any grab handles on the door. >450 mm single >850 mm double >450 mm single

3.3 Windows and Ventilation

Front Wind Screen	Laminated safety toughened glass 4-5mm thick, plain, Flat with curved corners.
Rear windscreen	Laminated safety toughened glass of 4-5mm thick, plain, Flat with curved corners.

3.4 Ergonomics

Interior Free Standing Height (m)	2.2 - 2.4
Floor Height (mm) MB/LB	< 650

First step	Measured from the ground to top of step nosing (without kneeling in operation)
SB	< 200 mm
MB/LB	Front <250 mm Rear <260 mm With kneeling: Front <280 mm
Any additional steps including aisle or seat plinths	Steps (maximum two) <200 mm Plinths <200 mm Step depths >200mm

Section four: Passenger safety

4.1 Introduction

Passenger safety, speed and security of movement while boarding, accessing and leaving seated positions, and alighting is paramount to the provision of a service that is attractive and timely to the public, and one in which they can have confidence.

There are a range of features that contribute to the overall safety performance and ease of use of a bus and these are detailed in this section.

4.2 Step and plinth edges

All steps at door entry and exits or within the vehicle must have full width step edges and faces fitted with a distinctive high-visibility, non-slip/trip style nosing that contrasts, i.e. a solid band of contrasting color, with the immediately adjacent flooring material. The nosing dimensions in the horizontal and vertical planes must be within the range

45-50 mm in width. Sharks tooth style is not preferred. Plinths must have a minimum of similar nosing on the horizontal edge.

4.3 Stanchions/handrails

Vertical high-visibility contrasting color stanchions from either floor to ceiling or seatback to ceiling, as location dictates, should be fitted throughout the length of the bus and close to the aisle so that they are spaced at alternate seats left and right of the aisle, and a passenger can walk/move the length of the bus while able to hold a stanchion with one hand at all times. Additional stanchions are required immediately adjacent to doorways and in priority seating or wheelchair areas if not already fitted as above. In areas where seating may have been reduced to provide for more people to stand, priority seating or wheelchair positions, or is of the folding style, then overhead contrasting color handrails are required. These should be no higher than 1900 mm from floor level.

Stanchion/handrail maximum cross-section dimension should be in the range of 30-35 mm and may be of a circular or elliptical cross section. For handrails, they should have a clear space of not less than 45 mm between any part of the vehicle and all parts of a handrail other than its mountings. Knurling is not encouraged for general cleanliness and hygiene reasons.

4.4 Grab handles

As with stanchions and handrails, all grab handles should be of the same high visibility contrasting color material, and have a circular or elliptical cross section of 30-35 mm on the maximum section.

In addition to the mandatory grab handles required to be fitted to doors, grab handles are also required in the following:

- Any priority seating area located to be readily accessible to any seated or wheelchair passengers, eg on the side walls where experience indicates short handles do not provide the assistance necessary.
- Fare paying area.

- Integral to all seatbacks (except for rearmost seats) on the aisle side of any Forward or rearward facing seat and should be such that there is >45 mm finger clearance to the handle.
- On the underside of any folding seat located to provide a firm handle to any wheelchair passenger when maneuvering into, out of or occupying a wheelchair space.

Section five: Passenger comfort and use

5.1 Seating

Passenger Area	0.202 m2 Area per passenger	
Seat width	single seat	>425 mm
	double bench or paired mother and child, on front wheel arch	>875 mm >810 mm
Spacing	forward facing	>670 mm
Seat Material	Suitable for useful life of about one calendar year during urban operation.	

5.2 Demisting

A demisting system that ensures the following are kept clear at all times when the bus is carrying passengers:

- The driver's windscreen
- All quarter light windows if fitted
- Front door windows.

It is also desirable to ensure that all side windows and door windows forward of the rear axle are kept clear.

5.3 Lighting Passenger Compartment

Sunken type tube light assembly of 20 watt transistorized inverter with slim type 600 mm long fluorescent tube rod of 18 watt.

5.4 Electrical System

24 Volt Dc

- 6.0** The specifications cover the main end use based design features of various floor height city operation buses for transportation of passengers mainly in Punjab urban/municipal areas.

The bus design shall be energy efficient, environment friendly, safe, efficient and reliable besides meeting all statutory, legal and other requirements, as also those related to easy passenger accessibility including for persons with disabilities, passenger comfort, drivers work place, internal and external aesthetics, a of repair and maintenance etc.

The bus specification envisages compliance with all applicable central, state and local laws (including Acts, Rules and Regulations).The bus shall meet the or exceed the motor vehicle rules of Pakistan/safety norms ,Emission and other norms applicable at the time of supply. In the event of any conflict between the requirements emanating from these specifications and those as per any statutory/legal, etc in force, the superior/higher requirements/standard shall prevail.

6.2 General Design Feature of the Bus

- 6.2.1 The full forward control urban bus shall have right hand drive and be fitted with engine at the front/Rear of the bus. The bus shall be designed and manufactured in accordance with specifications and international code of practice for bus body design. The bus shall be designed to carry commuters in the urban /municipal area with ease of boarding and alighting especially for ladies, senior citizens and persons with disabilities. The bus shall be provided with wheel chair disabled persons friendly access system. The bus design shall be suitable for daily operation for 16 to 20 hours in an urban passenger transport system with peak loading of about 150% of bus capacity(each passenger weighing 68 kg on an average),average journey speed of about 18 Kms per hour with frequent

stops/starts, say, after 200 to 700 meters. The max attainable speed of the bus shall be in the range of 70-80 kph.

6.2.2 The bus design shall be eco friendly and energy efficient meeting specified exhaust emission norms (Euro-II or the latest as amended up to the date of supply).

6.2.3 The bus shall be proven design suitable modified to the climatic and operational conditions, infrastructure and road conditions as available in the urban/municipal areas of Punjab.

6.2.4 The bus design shall meet all statutory requirements applicable for the city of Punjab in all respects.

6.2.5 The bus structure shall meet the requirements of structural strength, stability, deflection, vibration, crashworthiness, roll over protection etc. Amongst others for at least the following main loads:

- a. Static loads
- b. Dynamic loads
- c. Single Wheel bump loads
- d. Double wheel bump (Diagonally opposite) loads
- e. Braking and acceleration loads
- f. Front impact loads
- g. Roll over loads
- h. Speed breaker induced loads

6.2.6 The bus body design shall be a proved design duly evaluated by the agencies authorized as per MVR / Pakistan Engineering Development Board.

6.2.7 The minimum required performance values/data for above load conditions may be considered as follow:

- a. Strength (Factor of safety): minimum of 3 (tolerance minus 10%)
i.e. Design stress shall be 1/3 rd of yield stress.
- b. Stiffness (Deflection): 5mm.
- c. Vibrations (Lowest Natural Frequency):5Hz

d. Frontal Impact:

(Velocity = 56 Kph against fixed rigid barrier)

Head Injury Criterion (HIC) = 900

Crumbled Zone = 140 mm

No part of structure shall intrude into residual space.

(HIC= Head Injury Criterion calculation is based on the acceleration level at the head of the driver/ passenger & the time duration during which the maximum value of above acceleration is built up. Typical acceleration at the head should not exceed 80g continuously for 3 milli seconds to avoid head cracks).

e. Roll over (as per international bus code) tests with modifications of making the bus roll from ground level instead of the raised platform:

i. Bus tilted to its unstable position

ii. Bus allowed falling freely under gravity from this position.

f. Buckling Factor shall be equal to or more than four.

g. Various loads:

Normal Loads (Static) = No. of Passengers x wt. of passengers (68 Kgs.) + passenger luggage weight (7 Kgs). (Besides the vehicle related loads).

Bump Loads:

Bump height = as per relevant international standards.

Case I: Single Wheel on Bump/Pot hole.

Case II: Diagonally opposite wheels on Bump/Pot hole.

Case III: Both wheels (Front & Rear) on Bump/Pot hole.

h. Braking Loads:

Horizontal = 0.5g load

Vertical = 1.025g load

(Applied together)

6.2.8 The bus, loaded to Gross Vehicle Weight (GVW), with crush load and under static conditions, shall not exhibit deflection or deformation that impairs the operation of the steering mechanism, doors, windows, passenger escape mechanisms and service doors.

- 6.2.9 Besides meeting the statutory requirements the bus shall be designed with respect to its body and different aggregates/systems /sub systems to operate satisfactorily in urban transport service for at least 10 years or 7,50,000 Km whichever is later.
- 6.2.10 The material used in the construction of buses shall be as per Society of Automotive Engineers (SAE)/ specifications and /or other international specifications meeting/ surpassing the performance & other requirements as given in the international Bus Code. Wherever Pakistani standards are not available, internationally acceptable standards may be referred. Specifications/ standards followed shall conform to the Specification/Standards as amended /up dated/ or the latest published by the concerned agencies.
- 6.2.11 Any other provisions/fitments required for safe and efficient operation and or for fulfilling statutory requirements be provided in the offered bus.
- 6.2.12 The bus shall be so designed to maintain operational stability requirement as per international standards. Interior noise and pass by noise of the vehicle shall confirm.

7.0 Engine

- 7.1 CNG fuelled engine shall have adequate horse power to obtain desired performance in respect of its adequacy of power, acceleration levels, emission norms, specific fuel consumption etc The engine to have adequate horsepower not only to propel the bus but also to operate efficiently all other auxiliary devices fitted to the bus, if any. As the bus is required for operation in urban services, engines of adequate horse power at lower RPM levels with a high torque over a larger RPM range (over the lower side of the RPM range) be considered for use.
- 7.2 Engine should be able to operate efficiently at ambient temperatures of approximately Zero degree Celsius to 50 degree Celsius, humidity level from 5% to 100%, and altitude levels of over 500 meters of Punjab municipal areas.
- 7.3 The engine and its accessories shall be easily replaceable. The engine

mounting shall be such as to minimize transmission of vibrations to the bus structure. The engine foundation & mounting shall be so located as to facilitate easy accessibility & replacement. Engine design shall be such that it shall not be overheated during normal operating conditions of vehicle. An arrangement for audio-visual signal shall be provided in the event of engine getting overheated excessively. The temperature at which the signal operates shall be indicated. Similar arrangement for other sub-system of engine with their monitor able indicators is made on the dashboard.

- 7.4 The engine compartment shall be insulated to avoid transmission of heat and noise to saloon area. The passenger & engine compartments shall be separated by a bulkhead(s) that shall, by incorporation of fireproof materials preferably of ceramic fiber of minimum density of 128 Kgs/cubic meter in its construction, be a firewall. The engine compartment shall include areas where the engine and exhaust systems are housed including the muffler, if mounted above the horizontal shelf. This firewall shall preclude or retard propagation of an engine compartment fire into the passenger compartment. Only necessary openings shall be allowed in the firewall, and these shall be fireproofed. Wiring may pass through the bulkhead only if connectors or other means are provided to prevent or retard fire propagation through the firewall. Engine access panels in the firewall shall be fabricated of fire proof material and secured with fireproof fasteners. These panels, their fasteners, and the firewall shall be constructed and reinforced to minimize warping of the panels during a fire that will compromise the integrity of the firewall.
- 7.5 The engine shall be suitably designed to operate optimally under Punjab peak summer heat and dust. Suitable lighting arrangement with separate switch shall be provided for the engine compartment.
- 7.6 Engine noise and emission levels must conform to the Motor Vehicle Rules (MVR)/EDB/any other Pakistani standards, adopting the most superior one.
- 7.7 Specific fuel consumption of C NG per KM hour at standard conditions

shall be indicated along with expected fuel consumption level (kilometers per kg of CNG) under GVW and urban operational conditions.

- 7.8 For sound-proofing & for protection against fire risk in engine compartment no flammable material or material liable to soak fuel, lubricant or any combustible material shall be used in the engine compartment unless the material is clad by an impermeable fireproof sheet. A partition of heat resistant material shall be fitted between the engine compartment & any other source of heat.
- 7.9 A mechanism in the engine compartment shall be provided to prevent start of the engine from driver's seat while maintenance is being carried out near the engine compartment area.
- 7.10 Cooling system: Heavy-duty radiator and other subsystems of cooling system shall be designed to efficiently dissipate heat from the engine system. De-aeration tank and pressurized radiator cap shall be provided. It shall be easy for filling and level checking of coolant. Replacement/ maintenance of radiator and its items are also easily carried out.

8.0 Paint

All the structural members of the bus shall be treated for corrosion prevention internally as well as externally and painted wherever required. The Polyurethane (PU) painting conforming to latest/ international standards as applicable shall be used for exteriors painting of the bus including interiors wherever required. Color shade shall match to the shades as per SAE: 5-1978 or latest. Details of paints used, surface treatment & preparation, corrosion prevention treatment, base primer coatings, number of paint coats to be applied etc shall be supplied.

9.0 Color Schemes

Exterior, interior color schemes including floor color and logo/ graphics shall be painted as directed by the LTC.

10.0 Windows

The window shall be in two-piece design with flat and fixed top window glass and sliding bottom window glasses. Window shall be tinted with transparency level as per international standards. The toughened glass wherever

used in the body shall be 4.8 mm to 5.3 mm thick. The fixed top window glasses & bottom sliding glasses shall be aesthetically installed. The size and shape of the glasses shall enable even the standees to have maximum outside view without kneeling. The general requirements of windows shall be as per the provisions of bus code.

11.0 First Aid Kit

First aid kit complete with items, medicines, bandages etc. shall be provided as per the provisions of MVR fitted near driver seat at appropriate position and level on side with proper reinforcement.

12.0 Tool kit

The manufacturer shall provide a suitable tool kit and other mandatory items as per MVR 138 (4)/ other applicable rules comprising of common tools and other essential items required. The complete list of tools in the tool kit to be supplied with every bus shall be supplied by the manufacturer. One Hydraulic Jack per bus of a capacity of at least 10 Ton as per design of the bus shall also be supplied.